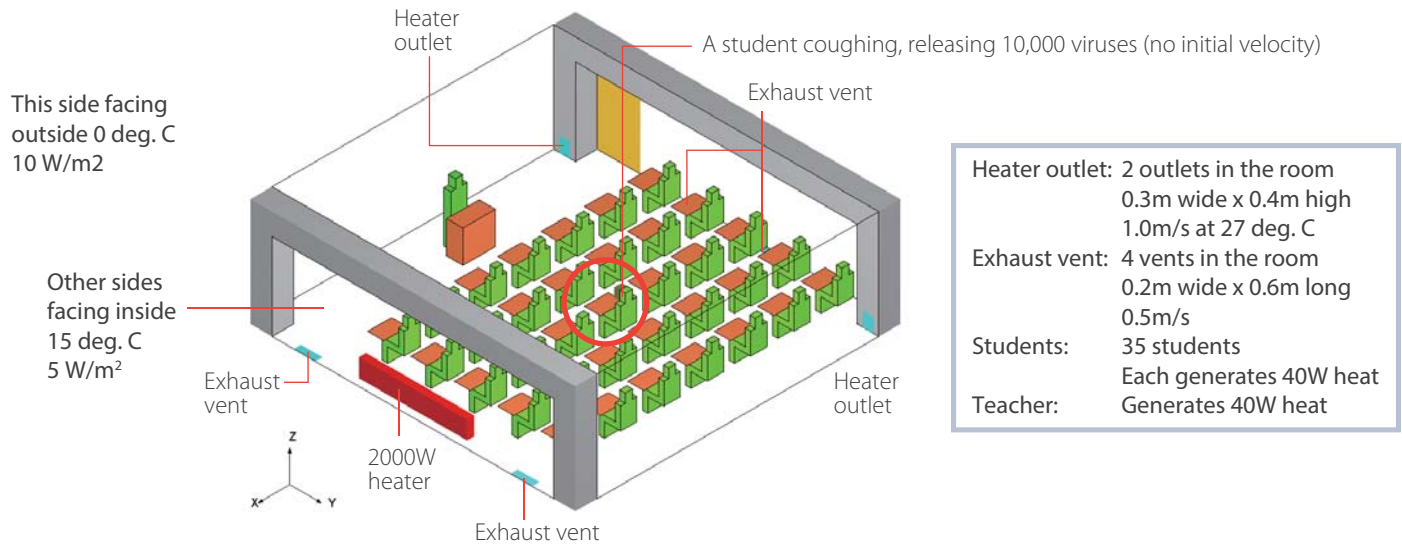# Spread of Virus in a Classroom

scSTREAM is used to simulate the spread of a virus in a classroom environment. Assuming a cold winter day, the flu viruses are modeled and calculated as diffusion species transported by the air flow.

Simulation Model

Heater outlet

A student coughing, releasing 10,000 viruses (no initial velocity)

Exhaust vent

This side facing outside 0 deg. C
10 W/m2

Other sides facing inside
15 deg. C
5 W/m²

Exhaust vent

2000W heater

Heater outlet

Exhaust vent

Heater outlet: 2 outlets in the room
0.3m wide x 0.4m high
1.0m/s at 27 deg. C
Exhaust vent: 4 vents in the room
0.2m wide x 0.6m long
0.5m/s
Students: 35 students
Each generates 40W heat
Teacher: Generates 40W heat

Calculation Setup

Air flow is calculated using a steady-state simulation with buoyancy. Then, using the resultant steady-state flow field, the diffusion of the virus is calculated using transient simulation.
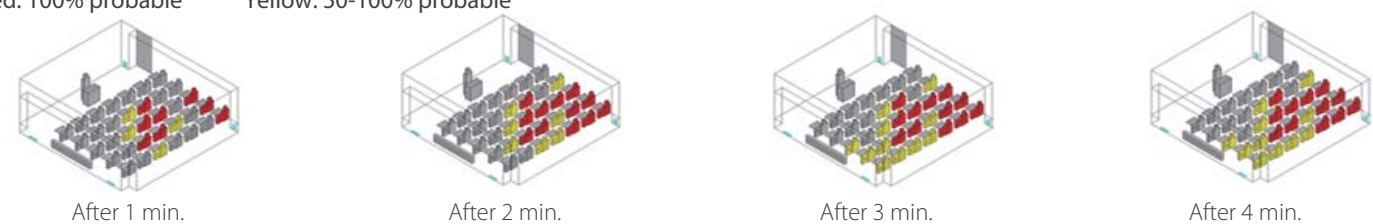
Results

Virus distribution at around head height (between 0.9m and 1.5m)

Red: Concentration >1   Yellow: Concentration > 0.5

| After 1 min. | After 2 min. | After 3 min. | After 4 min. |
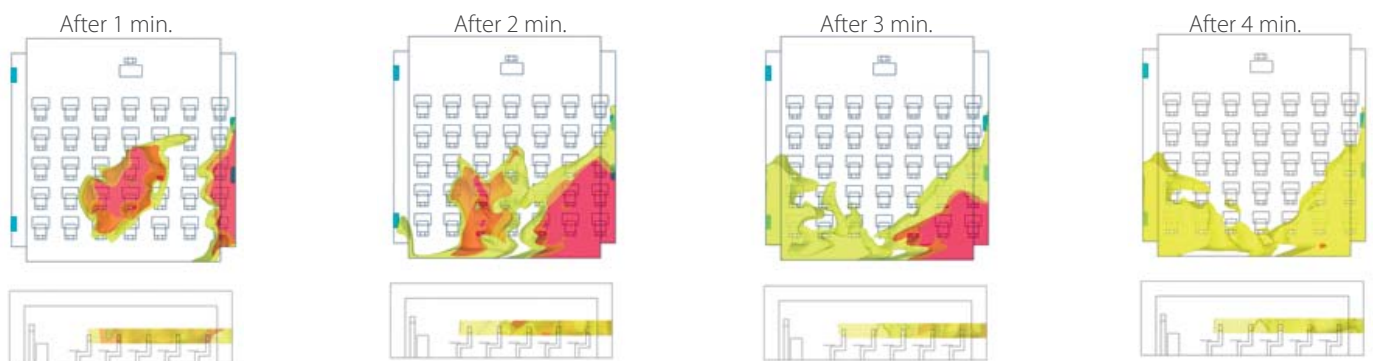
Students exposed to viruses

Red: 100% probable   Yellow: 50-100% probable

| After 1 min. | After 2 min. | After 3 min. | After 4 min. |

Notes

Using scSTREAM to simulate classroom air flow and virus diffusion shows that more than half of the students in the classroom will be exposed to viruses from a student seated in the middle of the room. Students who do not feel well should be strongly encouraged to stay home until they feel better.